AMENDMENTS TO THE CLAIMS

Claims 1-60 (Cancelled)

Claim 61 (Previously Presented): A device for recovering a high frequency content of a wideband signal previously down-sampled and for injecting said high frequency content in an over-sampled synthesized version of said wideband signal to produce a full-spectrum synthesized wideband signal, said high-frequency content recovering device comprising:

a) a random noise generator for producing a noise sequence having a given spectrum;

b) a spectral shaping unit for shaping the spectrum of the noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

c) a signal injection circuit for injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 62 (Previously Presented): A high-frequency content recovering device as defined in claim 61, wherein said random noise generator is a random white noise generator for producing a white noise sequence having a flat spectrum over the entire frequency bandwidth of the wideband signal, whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 63 (Previously Presented): A high-frequency content recovering device as defined in claim 62, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of said linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 64 (Previously Presented): A method for recovering a high frequency content of a wideband signal previously down-sampled and for injecting said high frequency content in an over-sampled synthesized version of said wideband signal to produce a full-spectrum synthesized wideband signal, said high-frequency content recovering method comprising:

a) randomly generating a noise sequence having a given spectrum;

b) spectrally-shaping said noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

c) injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 65 (Previously Presented): A high-frequency content recovering method as defined in claim 64, wherein generating said noise sequence comprises randomly generating a white noise sequence whereby said spectral shaping of the noise sequence produces a spectrally-shaped white noise sequence.

Claim 66 (Previously Presented): A high-frequency content recovering method as defined in claim 65, wherein said spectral shaping of the noise sequence comprises:

a) producing a scaled white noise sequence in response to said white noise sequence and a set of gain adjusting parameters;

b) filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) band-pass filtering said filtered scaled white noise sequence to produce a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 67 (Previously Presented): A decoder for producing a synthesized wideband signal, comprising:

a) a signal fragmenting device for receiving an encoded version of a wideband signal previously down-sampled during encoding and extracting from said encoded wideband signal version at least pitch codebook parameters, innovative codebook parameters, and linear prediction filter coefficients;

b) a pitch codebook responsive to said pitch codebook parameters for producing a pitch codevector;

c) an innovative codebook responsive to said innovative codebook parameters for producing an innovative codevector;

d) a combiner circuit for combining said pitch codevector and said innovative codevector to thereby produce an excitation signal;

e) a signal synthesis device including a linear prediction filter for filtering said excitation signal in relation to said linear prediction filter coefficients to thereby produce a synthesized wideband signal, and an oversampler responsive to said synthesized wideband signal for producing an over-sampled signal version of the synthesized wideband signal; and

f) a high-frequency content recovering device comprising:

i) a random noise generator for producing a noise sequence having a given spectrum;

ii) a spectral shaping unit for shaping the spectrum of the noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

iii) a signal injection circuit for injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 68 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 67, wherein said random noise generator comprises a random white noise generator for producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 69 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 68, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 70 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 69, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gain adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 71 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 70, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 72 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 70, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$\textit{Energy scaling factor} = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \qquad , \qquad n=0,\ldots,N'-1.$$

where w' is said white noise sequence and u' is an enhanced excitation signal derived from said excitation signal.

Claim 73 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 70, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 1 - tilt \qquad \text{bounded by } 0.2 \; g_t \; 1.0$$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)} \qquad \text{, conditioned by tilt 0 and tilt rv.}$$

Claim 74 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 70, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor gt using the relation:

$$g_t = 10^{-0.6tilt} \qquad \text{bounded by } 0.2 \; g_t \; 1.0$$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 75 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 69, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 76 (Previously Presented): In a decoder for producing a synthesized wideband signal, comprising:

a) a signal fragmenting device for receiving an encoded version of a wideband signal previously down-sampled during encoding and extracting from said encoded wideband signal version at least pitch codebook parameters, innovative codebook parameters, and linerar prediction filter coefficients;

b) a pitch codebook responsive to said pitch codebook parameters for producing a pitch codevector;

c) an innovative codebook responsive to said innovative codebook parameters for producing an innovative codevector;

d) a combiner circuit for combining said pitch codevector and said innovative codevector to thereby produce an excitation signal; and

e) a signal synthesis device including a linear prediction filter for filtering said excitation signal in relation to said linear prediction filter coefficients to thereby produce a synthesized wideband signal, and an oversampler responsive to said synthesized wideband signal for producing an over-sampled signal version of the synthesized wideband signal;

the improvement comprising a high-frequency content recovering device comprising:

i) a random noise generator for producing a noise sequence having a given spectrum;

ii) a spectral shaping unit for shaping the spectrum of the noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

iii) a signal injection circuit for injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 77 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 76, wherein said random noise generator comprises a random white noise generator for producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 78 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 77, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of said linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 79 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 78, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gain adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 80 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 79, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 81 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 79, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$\textit{Energy scaling factor} = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \quad , \qquad n=0,\ldots,N'-1.$$

where $\boldsymbol{w}'$ is said white noise sequence and $\boldsymbol{u}'$ is an enhanced excitation signal derived from said excitation signal.

Claim 82 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 79, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$g_t = 1 - tilt$ bounded by 0.2 g_t 1.0

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 83 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 79, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 10^{-0.6tilt}$$

bounded by 0.2 g_t 1.0

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 84 (Previously Presented): A decoder for producing a synthesized wideband signal as defined in claim 78, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 85 (Previously Presented): A cellular communication system for servicing a large geographical area divided into a plurality of cells, comprising:

a) mobile transmitter/receiver units;

b) cellular base stations respectively situated in said cells;

c) a control terminal for controlling communication between the cellular base stations;

d) a bidirectional wireless communication sub-system between each mobile unit situated in one cell and the cellular base station of said one cell, said bidirectional wireless communication sub-system comprising, in both the mobile unit and the cellular base station:

i) a transmitter including an encoder for encoding a wideband signal and a transmission circuit for transmitting the encoded wideband signal; and

ii) a receiver including a receiving circuit for receiving a transmitted encoded wideband signal and a decoder for decoding the received encoded wideband signal, said decoder comprising:

(1) a signal fragmenting device for receiving an encoded version of a wideband signal previously down-sampled during encoding and extracting from said encoded wideband signal version at least pitch codebook parameters, innovative codebook parameters, and linear prediction filter coefficients;

(2) a pitch codebook responsive to said pitch codebook parameters for producing a pitch codevector;

(3) an innovative codebook responsive to said innovative codebook parameters for producing an innovative codevector;

(4) a combiner circuit for combining said pitch codevector and said innovative codevector to thereby produce an excitation signal;

(5) a signal synthesis device including a linear prediction filter for filtering said excitation signal in relation to said linear prediction filter coefficients to thereby produce a synthesized wideband signal, and an oversampler responsive to said synthesized wideband signal for producing an over-sampled signal version of the synthesized wideband signal; and

(6) a high-frequency content recovering device comprising:

a) a random noise generator for producing a noise sequence having a given spectrum;

b) a spectral shaping unit for shaping the spectrum of the noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

c) a signal injection circuit for injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 86 (Previously Presented): A cellular communication system as defined in claim 85, wherein said random noise generator comprises a random white noise generator for producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 87 (Previously Presented): A cellular communication system as defined in claim 86, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 88 (Previously Presented): A cellular communication system as defined in claim 87, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gain adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 89 (Previously Presented): A cellular communication system as defined in claim 88, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 90 (Previously Presented): A cellular communication system as defined in claim 88, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$\text{Energy scaling factor} = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \quad , \qquad n=0,\ldots,N'-1.$$

where w' is said white noise sequence and u' is an enhanced excitation signal derived from said excitation signal.

Claim 91 (Previously Presented): A cellular communication system as defined in claim 88, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 1 - tilt \qquad \text{bounded by } 0.2 \; g_t \; 1.0$$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 92 (Previously Presented): A cellular communication system as defined in claim 88, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 10^{-0.6tilt}$$ bounded by 0.2 g_t 1.0

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$, conditioned by *tilt* 0 and *tilt* r_v.

Claim 93 (Previously Presented): A cellular communication system as defined in claim 87, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 94 (Previously Presented): A cellular mobile transmitter/receiver unit comprising:

a) a transmitter including an encoder for encoding a wideband signal and a transmission circuit for transmitting the encoded wideband signal; and

b) a receiver including a receiving circuit for receiving a transmitted encoded wideband signal and a decoder for decoding the received encoded wideband signal, said decoder comprising:

i) a signal fragmenting device for receiving an encoded version of a wideband signal previously down-sampled during encoding and extracting from said encoded wideband signal version at least pitch codebook parameters, innovative codebook parameters, and linear prediction filter coefficients;

ii) a pitch codebook responsive to said pitch codebook parameters for producing a pitch codevector;

iii) an innovative codebook responsive to said innovative codebook parameters for producing an innovative codevector;

iv) a combiner circuit for combining said pitch codevector and said innovative codevector to thereby produce an excitation signal;

v) a signal synthesis device including a linear prediction filter for filtering said excitation signal in relation to said linear prediction filter coefficients to thereby produce a synthesized wideband signal, and an oversampler responsive to said synthesized wideband signal for producing an over-sampled signal version of the synthesized wideband signal; and

vi) a high-frequency content recovering device comprising:

(1) a random noise generator for producing a noise sequence having a given spectrum;

(2) a spectral shaping unit for shaping the spectrum of the noise sequence in relation to linear prediction filter coefficients related to said down-sampled wideband signal; and

(3) a signal injection circuit for injecting said spectrally-shaped noise sequence in said over-sampled synthesized signal version to thereby produce said full-spectrum synthesized wideband signal.

Claim 95 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 94, wherein said random noise generator comprises a random white noise generator for producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 96 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 95, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 97 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 96, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gain adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 98 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 97, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 99 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 97, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$\textit{Energy scaling factor} = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \quad , \qquad n=0,\ldots,N'-1.$$

where $\boldsymbol{w}'$ is said white noise sequence and $\boldsymbol{u}'$ is an enhanced excitation signal derived from said excitation signal.

Claim 100 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 97, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$g_t = 1 - tilt$ bounded by 0.2 g_t 1.0

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 101 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 97, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor g_t using the relation:

$g_t = 10^{-0.6 tilt}$ bounded by 0.2 g_t 1.0

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$

, conditioned by *tilt* 0 and *tilt* r_v.

Claim 102 (Previously Presented): A cellular mobile transmitter/receiver unit as defined in claim 96, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 103 (Previously Presented): A cellular network element comprising:

a) a transmitter including an encoder for encoding a wideband signal and a transmission circuit for transmitting the encoded wideband signal; and

b) a receiver including a receiving circuit for receiving a transmitted encoded wideband signal and a decoder as recited in claim 67 for decoding the received encoded wideband signal.

Claim 104 (Previously Presented): A cellular network element as defined in claim 103, wherein said random noise generator comprises a random white noise generator for producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 105 (Previously Presented): A cellular network element as defined in claim 104, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 106 (Previously Presented): A cellular network element as defined in claim 105, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gains adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 107 (Previously Presented): A cellular network element as defined in claim 106, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 108 (Previously Presented): A cellular network element as defined in claim 106, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$\textit{Energy scaling factor} = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \quad , \qquad n=0,\ldots,N'-1.$$

where w' is said white noise sequence and u' is an enhanced excitation signal derived from said excitation signal.

Claim 109 (Previously Presented): A cellular network element as defined in claim 106, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 1 - \textit{tilt} \qquad \text{bounded by } 0.2 \; g_t \; 1.0$$

where

$$\textit{tilt} = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)} \quad , \text{ conditioned by } \textit{tilt} \; 0 \text{ and } \textit{tilt} \; r_v.$$

Claim 110 (Previously Presented): A cellular network element as defined in claim 106, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 10^{-0.6tilt}$$ bounded by $0.2 \; g_t \; 1.0$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$, conditioned by $tilt \; 0$ and $tilt \; r_v$.

Claim 111 (Previously Presented): A cellular network element as defined in claim 105, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 112 (Currently Amended) In a cellular communication system for servicing a large geographical area divided into a plurality of cells, comprising: mobile transmitter/receiver units; cellular base stations, respectively situated in said cells; and a control terminal for controlling communication between the cellular base stations:

a bidirectional wireless communication sub-system between each mobile unit situated in one cell and the cellular base station of said one cell, said bidirectional wireless communication sub-system comprising, in both the mobile unit and the cellular base station:

a) a transmitter including an encoder for encoding a wideband signal and a transmission circuit for transmitting the encoded wideband signal; and

b) a receiver including a receiving circuit for receiving a transmitted encoded wideband signal and a decoder as recited in claim 67 for decoding the received encoded wideband signal.

Claim 113 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 112, wherein said random noise generator comprises a random white noise generator for

producing a white noise sequence whereby said spectral shaping unit produces a spectrally-shaped white noise sequence.

Claim 114 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 113, wherein said spectral shaping unit comprises:

a) a gain adjustment module, responsive to said white noise sequence and a set of gain adjusting parameters, for producing a scaled white noise sequence;

b) a spectral shaper for filtering said scaled white noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered scaled white noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of said over-sampled synthesized signal version; and

c) a band-pass filter responsive to said filtered scaled white noise sequence for producing a band-pass filtered scaled white noise sequence to be subsequently injected in said over-sampled synthesized signal version as said spectrally-shaped white noise sequence.

Claim 115 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 114, further comprising:

a) a voicing factor generator responsive to said adaptive and innovative codevectors for calculating a voicing factor for forwarding to said gain adjustment module;

b) an energy computing module responsive to said excitation signal for calculating an excitation energy for forwarding to said gain adjustment module; and

c) a spectral tilt calculator responsive to said synthesized signal for calculating a tilt scaling factor for forwarding to said gain adjustment module;

wherein said set of gain adjusting parameters comprises said voicing factor, said energy scaling factor, and said tilt scaling factor.

Claim 116 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 115, wherein said voicing factor generator comprises a means for calculating said voicing factor r_V using the relation:

$$r_v = (E_v - E_c) / (E_v + E_c)$$

where E_v is the energy of a gain-scaled version of the pitch codevector and E_c is the energy of a gain-scaled version of the innovative codevector.

Claim 117 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 115, wherein said gain adjusting unit comprises a means for calculating an energy scaling factor using the relation:

$$Energy\ scaling\ factor = \sqrt{\frac{\sum_{n=0}^{N-1} u'^2(n)}{\sum_{n=0}^{N'-1} w'^2(n)}} \quad , \quad n=0,\ldots,N'-1.$$

where w' is said white noise sequence and u' is an enhanced excitation signal derived from said excitation signal.

Claim 118 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 115, wherein said spectral tilt calculator comprises a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 1 - tilt \qquad \text{bounded by } 0.2\ g_t\ 1.0$$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)} \qquad \text{, conditioned by } tilt\ 0 \text{ and } tilt\ r_v.$$

Claim 119 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 115, wherein said spectral tilt calculator comprising a means for calculating said tilt scaling factor g_t using the relation:

$$g_t = 10^{-0.6tilt} \qquad \text{bounded by } 0.2\ g_t\ 1.0$$

where

$$tilt = \frac{\sum_{n=1}^{N-1} s_h(n)\, s_h(n-1)}{\sum_{n=0}^{N-1} s_h^2(n)}$$, conditioned by *tilt* 0 and *tilt* r_v.

Claim 120 (Previously Presented): A bidirectional wireless communication sub-system as defined in claim 114, wherein said band-pass filter comprises a frequency bandwidth located between 5.6 kHz and 7.2 kHz.

Claim 121 (New): A high-frequency content recovering device as defined in claim 61, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 122 (New): A high-frequency content recovering method as defined in claim 64, wherein said spectral shaping of the noise sequence comprises filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized sound signal version.

Claim 123 (New): A decoder for producing a synthesized wideband signal as defined in claim 67, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 124 (New): A decoder for producing a synthesized wideband signal as defined in claim 76, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a

filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 125 (New): A cellular communication system as defined in claim 85, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 126 (New): A cellular mobile transmitter/receiver unit as defined in claim 94, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 127 (New): A cellular network element as defined in claim 103, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.

Claim 128 (New): A bidirectional wireless communication sub-system as defined in claim 112, wherein said spectral shaping unit comprises a spectral shaper for filtering the noise sequence in relation to a bandwidth expanded version of the linear prediction filter coefficients to produce a filtered noise sequence characterized by a frequency bandwidth generally higher than a frequency bandwidth of the over-sampled synthesized signal version.